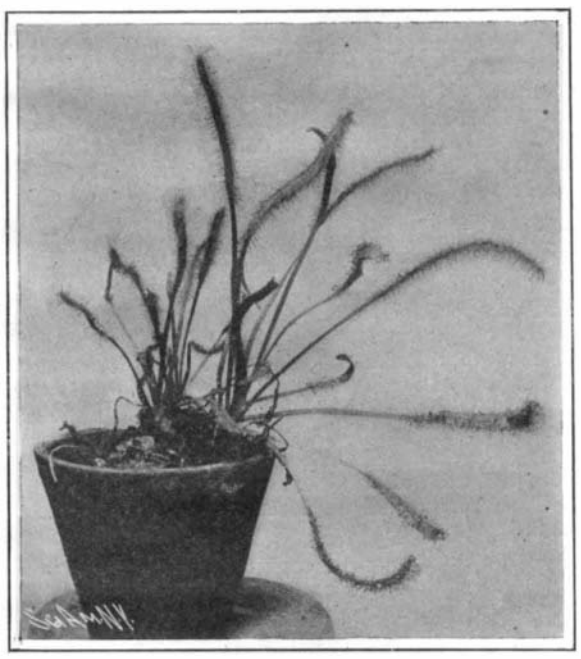
FLOWERS THAT FEEL.*

By JOSEPH H. PAINTER.

IN all the wonderful storehouses of Dame Nature there is nothing more remarkable than her success in mimicking one object by another of widely different character, even that of a plant by an animal, as the "dead-leaf butterfly" (*Kallima*) of the East Indies and the "walking-sticks" (*Diapheromera*) of our own woods, and the habit of certain plants of feeding upon animals and of mimicking their actions. For there are five hundred species of the vegetable world which, in one way or another, use animal matter in their struggle for a place among their mates. Some of these have a distinct apparatus by which the plant captures the luckless prey, but others produce a sticky secretion with which the insect becomes covered, and suffocates from the stopping of the breathing pores or starves from inability to obtain food. True, there are many plants which produce mucilage-covered stems, but often for the better protection afforded the flower from creeping visitors when the fertilization is provided for winged insects.

Among this number of so-called "carnivorous plants" is the family *Droseraceae*, the sun-dew family, the most commonly cultivated of which is *Drosera capensis*, a native of South Africa. This plant bears leaves which are elongated, slightly concave along the middle and bluntly pointed. They arise from an almost woody axis, but their greatest peculiarity is the green leaf-like footstalk or petiole below the gland-bearing blade. This blade extends from one-third to one-half the length of the entire leaf, and is covered with numerous tentacles. These project from the upper surfaces and margins, and are of unequal sizes, those on the margins being the longest. Each is tipped with a round gland, which secretes a sticky sweetened substance—the bait for the unfortunate insect. This secretion is clear and thick, and may easily be drawn out into threads. It shines in the sunlight as dew drops, hence the common name "sun-dew." If an insect alights upon the tentacle-covered blade, those tentacles nearest begin to draw together over the intruder, which struggles to free itself, each attempt only adding more and more to its already covered body until the breathing pores are closed up, and the tentacles close over it in their fatal grasp. Gradually those nearest draw together, then those farther away, until the whole leaf folds over the luckless prey. With some species of the genus this occurs in the remarkably short time of ten minutes. The moment one of the sensitive tentacles has been subjected to an irritation of some nitrogenous substance, as insects or a piece of meat (for the plants have the astounding faculty of discriminating against mineral substances) the secretion of the gland proceeds more rapidly. Besides an acid juice, as well as a ferment, is added to the sticky fluid to aid in the breaking down of the animal tissue, in order that the plant may absorb the nutritious portions. The action of these juices upon albuminous compounds is very similar to that of pepsin. It is only when the prey is very large that the leaf becomes hollowed in the middle, and more tentacles are brought to bear upon it. But if the creature is small, as a mite, the process is complete in two or three days, and the leaf reassumes its open position with the tentacles again straightened, so that the hard and dry portions of the insect are left upon the surface to be blown away by the first breeze that springs up. After an interval of rest lasting a couple of days the glands again secrete the sticky bait, and the leaf is ready for another meal.

The pitcher plants of the family *Sarraceniaceæ* are relatives of these insect-catching *Droseras*, for both families belong to the same order (*Sarraceniales*). These plants, too, capture insects, but they do so without the exhibition of any movement of themselves. Their leaves are variously shaped into hollow receptacles resembling trumpets, funnels, or pitchers. They are all natives of America: *Sarracenia*, containing



DROSERA CAPENSIS, SOUTH AFRICA.

about eight species, being found from Labrador to Florida, *Chrysamphora* (or *Darlingtonia*) with one species, in California, and *Heliamphora*, also with one species, in Venezuela.

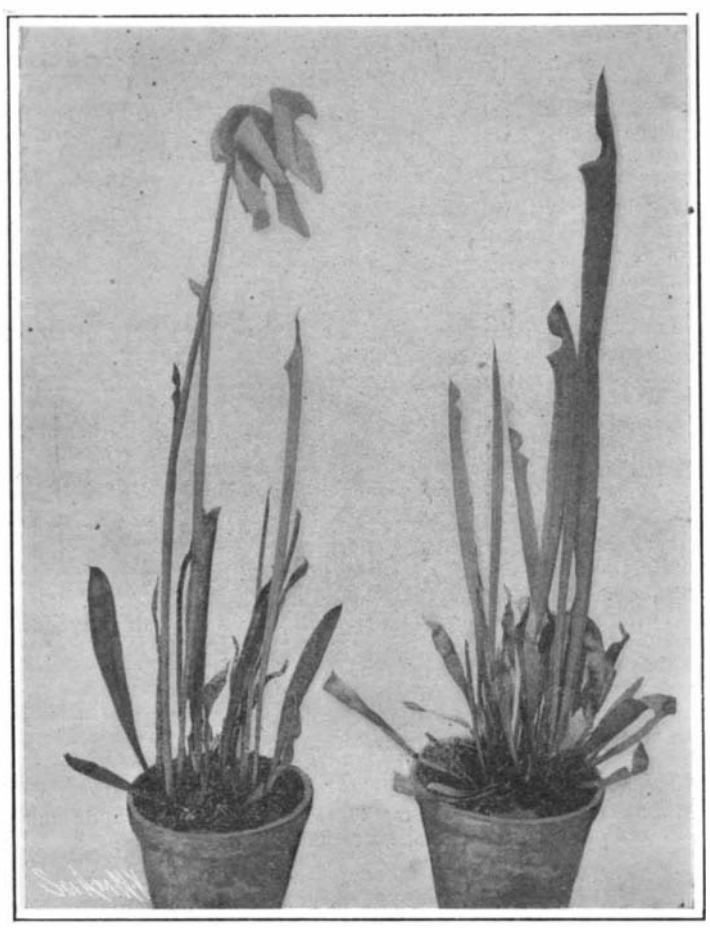
Of these various forms, the commonest and the one of widest range is the side-saddle flower or pitcher plant (*Sarracenia purpurea*). This is an inhabitant of bogs and marshes often associated with *Drosera* and other insect-catching plants. The leaves are in rosettes resting their bases on the damp earth, and thence curve upward. They are inflated like bladders, closed at the base, and with a hooded orifice at the top. Along the inner side extends a fin-like wing, which is marked with green and purple veining. This wing performs the true functions of the leaf, while the inflated portion is the trap set for insects.

The edge of the opening into the cup or pitcher opposite the hood bears a row of shell-like projections, which protrude into the cup and form a decided obstacle to the exit of any insect that is unfortunate enough to attempt to climb over it. Beneath and within this rim and over the inner surface of the hood are stiff downward-pointing bristles, among which are honey-producing glandular hairs, so that the parts about the aperture are coated with a thin film of sweet juice—the bait. Insects both with wings and without are attracted by this honey, which is more plentiful farther within and away from the rim of the cup. They get deeper and deeper into it, and then are unable to retrace their steps. Every attempt to climb up again is impossible, because of the presence of the bristles. Below the row or band of these bristles the inside lining of the walls is covered with smooth, slippery decurved cells, and these hinder still more the intruder in his efforts to escape. He slips on and on, and is drowned in the water with which the cup is partly filled. This water is obtained by the hood which, acting as a sort of funnel, catches the drops of rain and directs their flow into the cups. Whether this liquor filling the bottom of the pitchers is simply rain water mixed with the decaying bodies, or whether it is, in part, a secretion of the plant itself, is a matter still to be ascertained. It is sometimes clogged with the putrefying victims, so great is their number. When these captured animals are undergoing decomposition in the pitfalls, the liquid becomes brown in color, and often gives off an offensive odor.

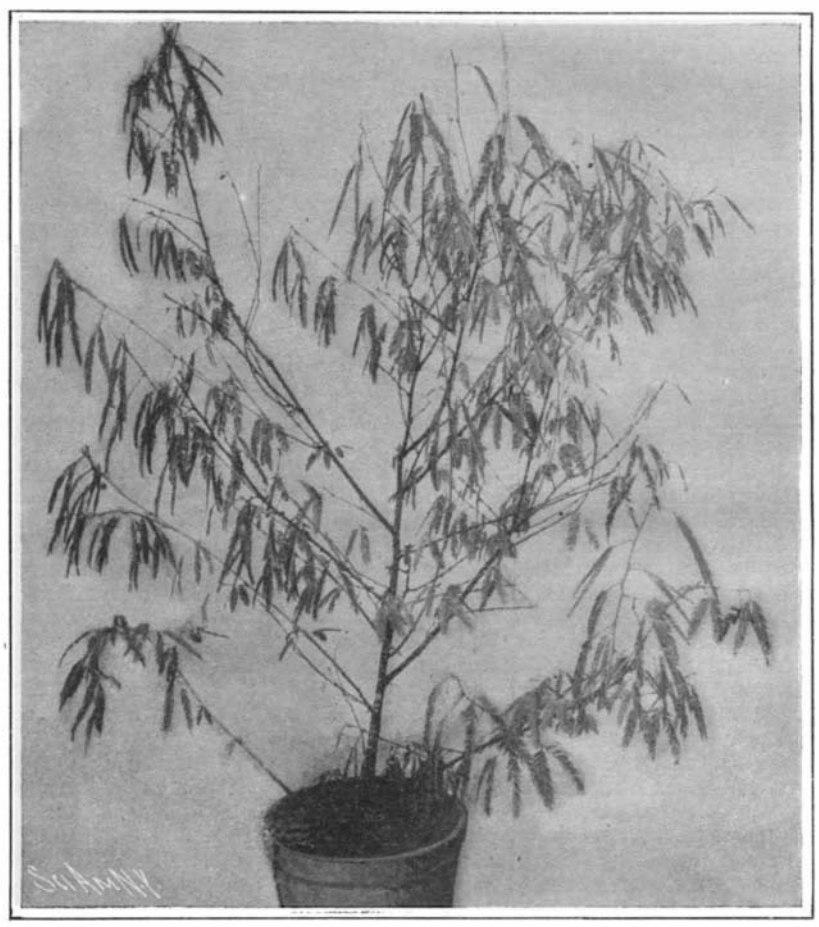
Yet within this same genus there is a great diversity in the apparatus adapted to the capture of prey. In the "trumpet-leaves" (*Sarracenia rubra* and *S. drummondii*) of our Southern States the liquid contained within the tube-like leaves has an acid reaction, and is secreted by the cells in the interior of the cavity itself. Because of the presence of the hood, which in these plants becomes a sort of lid, the orifice is closed to the entrance of rain drops, but is not a hindrance to the entrance of insects into the pitfall. The rim around the aperture is turned back upon itself, and serves as a small platform upon which the insect alights from its flight, for because of the erect habit of these leaves, insects depending upon their feet alone for access have an almost impossible climb, and nothing to attract them to the position of the honey. About the mouth of the trumpet and on the under side of the lid are honey-secreting glands, which pour out their sweets in such abundance that it may often be seen as drops on the margin of the aperture and hanging from the lid. Serving as an attraction to the honey is the great variety and contrasting brightness of the colors of the trumpet. The veining is more prominent and often strikingly colored, and the upper half of the leaf is of a different shade from the lower part, being much lighter green and sometimes almost white. The visitor, attracted by the bright colors, finds and feeds upon the honey, and crawls over the edge into the interior. Here is the beginning of his troubles, for he is upon a dangerous footing. Among the honey-bearing cells are innumerable others which are smooth and conical, with the solid apices directed toward the base of the pitfall. Every attempt to withdraw only becomes an aid to destruction, for with each movement the honey seekers sink farther and farther toward the bottom of the pitcher, where they are drowned and ultimately entirely decomposed.

The "yellow-flowered trumpets" (*S. flava*) have an open lid, and do not secrete their own liquid, for rain can and does enter through the aperture. Otherwise they obtain their nitrogenous food as do the other trumpets already described.

Still farther specialized are the "monkey cups" (*Nepenthes*), in which the leaves are of three distinct parts. These natives of the tropical East bear their foliage just as ordinary plants, but strange as it is the mid-vein is prolonged beyond the blade of the leaf, and stranger still, this mid-vein bears at its tip a cup or pitcher often closely resembling the cups and pitchers of the *Sarracenias*. In most of the species of the genus the mature pitchers are from four to six inches in length and one inch in diameter, but one from Borneo (*N. rajah*) has a cup the height of which reaches twenty inches and has an orifice four inches in diameter, while below the orifice the pitcher



TRUMPETS. SARRACENIA PLAVA. SOUTHEASTERN UNITED STATES. FAMILY SARRACENIACEAE.



A MIMOSA OF ARGENTINE.

* Specially prepared for the SCIENTIFIC AMERICAN SUPPLEMENT.

expands to six inches. It is so large that a pigeon would be completely hidden within it. These pitchers, when immature, are mostly closed by the lid and of dull colors, but after maturity the lid opens and the pitcher becomes gayly colored. This makes them very conspicuous in their native densely-shaded forests. About the rims of the pitchers and on the under surface of the lid there is a secretion of sweets. This honey is often so plentiful that it may be seen glistening upon and even dripping from the fluted turned-over margins of the pitchers. Animals that suck honey from the lips of these cups wander inside, where the face of the cup is smooth and steep or even receding, and, too, it is covered with a slippery wax, which causes the invaders to slide down into the water with which the cups are partly filled. In large pitchers the egress is made even more improbable by the presence of sharp teeth upon the inside of the rim of the aperture. Most of the creatures that fall into the water are speedily drowned in the liquid. This is mainly rain-water but, as Dr. Hooker has shown, upon the presence of animal matter in the fluid the glands on the inner surface at the base of the pitcher add a secretion of a series of acids mixed with an organic compound resembling pepsin. From experiments it has been shown that these fluids act upon animal tissue in a way not only similar to digestion, but so nearly that process, it may be properly spoken of as digestion. The portions of the bodies of victims of *Nepenthes* which is acted upon by these fluids is afterward absorbed by special cells at the bottom and on the lining walls of the lower parts of the cups.

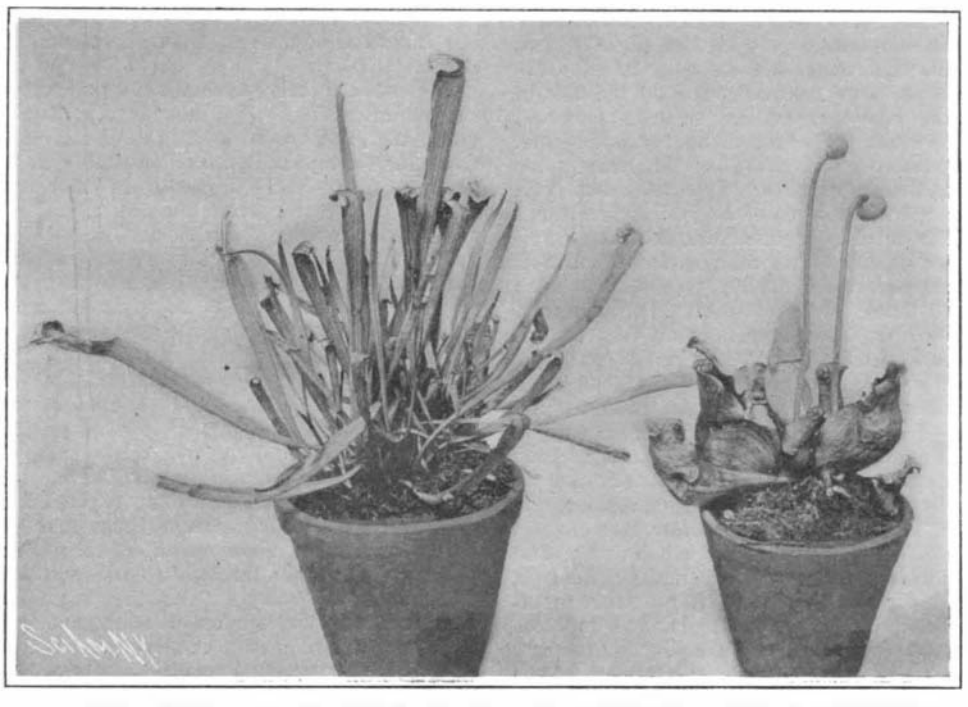
In all these plants the use to the plant is the obtaining of nitrogenous foods, of which they are deprived by the character of the soil in which they grow. But Dame Nature has still another series of interesting and astounding surprises for us in the plant world. There are many plants for which, instead of providing food in a wonderful way, she provides protection, both from falling raindrops, which would tear the delicate leaves, and from excessive evaporation, which would rob them of their moisture and cause their drying and final death. The most wonderful of these are the so-called sensitive plants or *Mimosas*, the commonest of which is *Mimosa pudica*, the true sensitive plant or humble plant of the gardens.

The leaves of this wonderful plant are doubly compound, there being two pairs of branches of the petiole or leaf-stalk, each branch bearing numerous leaflets arranged closely together, the outer leaflet overhanging the next when the leaves are fully expanded to the action of the air and light. These leaves show an immediate response to the action of a stimulant, being irritable in a very high degree, and answering to a shock so light as the shaking caused by one's steps past the table upon which the plant may be growing.

Upon pinching or otherwise applying a stimulant to one of the leaflets, the opposite leaflet to that upon which the stimulus acted will at once exhibit an irritation and will rise, almost simultaneously followed by the nearest neighboring leaflets in strict sequence as far as the base of the small leaf-stalk; then a pause will be noticed, but it will be immediately followed by the rising of the next lowest pair of leaflets on the other petiolules, and the movement will extend itself regularly toward the tips of the leaf. At the same time these petiolules draw toward each other somewhat like the closing of the outstretched fingers of the hand. Next the primary leafstalk droops, carrying with it the hanging leaflets. And, within a short space of time, the leaves next the one which has responded will exhibit the irritation, but acting in the reverse way—the petiole falling first, the petiolules next, and the leaflets folding last. All the leaves of a stalk of *Mimosa* may be thus set in motion, even though the stimulus has been applied to a single leaflet. This exhibition will last for varying lengths of time, depending, of course, upon the intensity of the force with which the plant was set moving. Finally, however, the petioles will resume their erect position, the petiolules will expand, and the leaflets will spread themselves out to the action of the light.

The benefits derived from this curious habit are many. The heavy drenching rains of their native tropics would tear the delicate leaflets, but at the touch of the first drop this is rendered impossible. It also happens that dry, dusty winds and driving sand and extraordinary noontime heat cause the folding of the leaflets. The leaflets escape the various dangers by this assumption of the "sleep movements"—in the clear night, the loss of water by radiation toward the sky; in the hot mid-day, drying up in consequence of rapid evaporation; in rainy weather, the breaking of the tender leaves and their inclination toward the ground, as well as the collapse of the whole plant under the weight of the falling drops.

NEPENTHES. A HYBRID WITH NEPENTHES HOOKERIANA.



ON THE RIGHT A PITCHER PLANT OF EASTERN NORTH AMERICA. ON THE LEFT A RED-FLOWERED TRUMPET LEAF SARRACENIA RUBRA OF SOUTHEASTERN UNITED STATES.

WHY THE EYES OF THE CHINESE SEEM TO BE OBLIQUE.

CONTRARY to the general opinion, the eyes of the yellow people are not oblique, notwithstanding the fact that they appear to be. In these people the line joining the commissures of the eyelids divides the eye into two equal parts, and is exactly at right angles with the axis of the nose. If it is not always so, the exception is much less frequent than in the whites, for, as a general rule, it is in the latter that the eyes are not at right angles with the nose. If our eyes seem to be so, it is due to habitude, and if those of the Chinese appear to be oblique, it is due to an optical illusion.

In order to convince ourselves of the influence of habitude, it will suffice to look at a well known face in a mirror by reflection, or, while shaving, for example, to regard one's self by double reflection in two parallel mirrors. As what is ordinarily seen to the right is observed to the left, and *vice versa*, unsuspected distortions and asymmetries suddenly appear. The effect, moreover, is exaggerated and, in a manner, doubled, since a line making an angle a with the horizontal, and taken for it, is afterward seen in a position making an angle $2a$ with its initial position. It is for the same reason that we rarely recognize ourselves in a full face portrait, while those to whom our face is familiar find it a very good likeness. The photographer endeavors to counteract this bad effect by never taking a full face view of his sitter, and by turning the latter's head in such a way as partially to correct, by the perspective, the asymmetry of the features. In this, however, he does not always succeed. The most eminent sinologists, Von Siebold, Abelsdorff, and Schlegel, are of the opinion that the eyes of the yellow people are straight. To be convinced of this, it is only necessary to examine one of their portraits, or, what is better, the original. If the eye appears to be oblique, it is due to the fact that the upper eyelid and the general direction of the eyebrow are oblique. The upper eyelid on the side toward the nose forms a special fold which causes it to cover entirely the angle in which the lachrymal gland is situated. The eyelids are generally thinner and the eye less open.

The head of the Japanese presents another curious peculiarity, from the fact that the lower lobe of the ear is almost totally lacking. This is not a real anomaly, however, for it is we who have a badly formed ear, or at least one different from that which nature would have given us if we had allowed her to act alone. Our ear has become deformed for the reason that for centuries our ancestors suspended therefrom more or less odd and heavy ornaments which progressively elongated the lower part of it. We have inherited both the custom and its effects, the lobe. A fact which well proves the absence of this useless and cruel custom among the yellow folk are the terms "earring" (*mimi-gauć*) and "ear-lobe" (*mimi-tabu*), neither of which was introduced into the Japanese language until the epoch at which the Japanese entered into relations with the people of the West, whom they styled barbarians.—Translated from La Nature for the SCIENTIFIC AMERICAN SUPPLEMENT.

THE PLACE OF CEREAL BREAKFAST FOODS IN THE DIET.*

IT has been estimated that a man at moderate work requires about a fifth of a pound of protein and about 3,000 calories of energy per day. As a general rule, the protein is in considerable measure supplied by meat, fish, milk, and other animal foods, which also supply the bulk of the fats. The carbohydrates, which are lacking in animal foods, are abundantly supplied by the vegetable foods, which also provide some protein and a little fat. Fresh fruits and vegetables supply acids and other bodies which are believed to have a distinct value as stimulants to the appetite and in other ways. The mineral matters needed in a well-balanced diet occur in small but sufficient quantities in almost all classes of food materials. In a mixed diet the energy-producing carbohydrates are more important ingredients of the vegetable foods than protein, which will be supplied by animal foods. Of course, if for any reason the animal foods are omitted from the diet, the importance of protein and fats in the vegetable foods increases greatly. In such cases the legumes and cereals, which contain more protein than the vegetables and fruits, take a very important position in the menu.

The most important use of cereals is undoubtedly as breadstuffs. Bread has thoroughly established its place as the most palatable, nutritious, and convenient cereal preparation for general use. Crackers or biscuit and the various kinds of cake, pastry, etc., are in a way varieties of bread or substitutes for it and are recognized as staple foods. What place, then, is left for the so-called breakfast foods?

At dinner, aside from bread and sweets, carbohydrates are supplied in the vegetables served with the meat. In the morning and sometimes also at luncheon or supper these do not seem so attractive or convenient and in their place we use some preparation of cereals. There are reasons for believing that there is a growing tendency in this country to use less meat at all meals, perhaps, excepting dinner. This, of course, increases the importance of cereal foods as part of the diet.

Some of the prepared cereal foods are pressed into cakes or in some other way manufactured into such forms that they may be eaten to a greater or less extent like bread or crackers as an accompaniment to various dishes. Such preparations are undoubtedly wholesome and nutritious, but except for their flavor and texture, which may appeal to many, they do not surpass the ordinary breads, which experiments have shown have as great or greater nutritive value and usually cost less. Cereal breakfast foods of different kinds are used to a greater or less extent in the preparation of made dishes. Thus, a spiced steamed pudding may be made from oatmeal, and very palatable little cakes can be made from some of the dry flaked cereals. Fried hominy and fried corn-meal mush are standard foods sometimes served with fried chicken and some other dishes, and boiled rice is a common substitute for potatoes or other starchy foods. The manufacturers of certain classes of goods have taken great pains to devise recipes for their use in making desserts and as ingredients of other dishes. The amount

* Abstracted from Farmers' Bulletin 249, issued by the United States Department of Agriculture.